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ABSTRACT

Investigated in the first of two studies on verbal elaboration in special populations (learning problem and retarded children) were the effects of paragraph elaboration on the paired-associate and reversal learning of 137 brain-injured and familial educable mentally retarded children 8- to 13-years-old. The relationship between brain-injury classification and performance on a six paired-associates list was significant only for acquisition. Data indicated the possible language and learning distinctions between brain-injured and non-brain-injured retardates. In the second study, 14 first grade students with learning problems in a transitional class were tested for the transfer effects of learning under elaboration conditions (paragraphs) to learning under nonelaboration conditions (labels). Results indicated that with a 24-hour transfer interval, two days' experience in using contexts for relating word pairs had beneficial effects on subsequent paired-associate performance when elaborative contexts were not provided. (CL)

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Two Studies on Verbal Elaboration in Special Populations

I. The Effects of Brain-Injury
II. Evidence of Transfer of Training

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Research, Development and Demonstration
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RESEARCH AND DEVELOPMENT CENTER
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The University of Minnesota Research, Development and Demonstration Center in Education of Handicapped Children has been established to concentrate on intervention strategies and materials which develop and improve language and communication skills in young handicapped children.

The long term objective of the Center is to improve the language and communication abilities of handicapped children by means of identification of linguistically and potentially linguistically handicapped children, development and evaluation of intervention strategies with young handicapped children and dissemination of findings and products of benefit to young handicapped children.

Abstract

Two studies were conducted to test some implications from the results of previous research (Turnure & Walsh, R & D Center Research Report No. 5, 1970).

In Study I, the effects of paragraph elaboration on the paired-associate learning and reversal of brain-injured and non-brain-injured retardates were investigated in 137 educable mentally retarded children. Analyses of the relationship between performance on a six paired-associates list and brain-injury classification were significant for acquisition only. The results tentatively suggest that the distinction between brain-injured and non-brain-injured retarded may be an important one to make when investigating language and learning abilities of retarded children.

To test for the transfer effects of learning under elaboration conditions (paragraphs) to learning under non-elaboration conditions (labels), Study II was carried out with 14 subjects from a transitional first-grade class. With a transfer interval of 24 hours, results indicated that two days of experience in using experimenter-provided contexts for relating word pairs did have beneficial effects on subsequent paired-associate performance when elaborative contexts were not provided. It was suggested that the experimental procedure of the present study would be of value for testing transfer in educable mentally retarded children when the transfer interval is increased to one week.

1. Effects of Brain-Injury on the Learning and Reversal of Paired-Associates in a Paragraph Elaboration Condition

James E. Turnure and Sharon N. Larsen

Two recent studies (Turnure, 1971; Turnure & Walsh, 1971) demonstrated that syntactic verbal elaboration greatly facilitates the learning and reversal of verbal paired-associates by educable mentally retarded children. In these studies, extended elaboration conditions consisting of two-sentence paragraphs resulted in learning and reversal slightly, but reliably, superior to that of single sentence elaboration and greatly superior to mere labeling of the items to be associated. Further, the paragraph elaboration subjects performed both learning and reversal virtually without error. Turnure and Walsh (1971) concluded that the verbal flexibility seen in the performance of the elaboration condition subjects demonstrates that, at least in these conditions, retarded subjects have quite adequate "inner language ability" (cf. McCarthy, 1964). These findings were discussed in relation to Luria's postulate (1963) of the existence of a profound verbal defect or "inertness" in the language system of the retarded. Turnure and Walsh (1971) reasoned that since the retarded subjects in their study demonstrated inner language ability adequate to respond to a reversal in the stimulus and response requirements of the paired-associate task almost without error, they could be

said to have active verbal systems. It was also suggested that despite the demurrers of western experts (cf. Dunn & Kirk, 1963; cf. also Wortis, 1967; Zigler, 1966), one should accept Luria's contention that his retarded subjects, who were characterized as having "inert" language, were all brain-injured.

The present study was undertaken in order to investigate the possibility suggested by Turnure and Walsh (1971) that positive effects of syntactic elaboration may occur differentially in familial and brain-injured retardates. Paragraph elaboration training on a paired-associate task, which has previously been shown to provide the greatest facilitory effect on learning and reversal (Turnure, 1971; Turnure & Walsh, 1971), was given to a large group of presumably heterogeneous educable mentally retarded children. Subsequent analyses of the data were performed to determine the relationship between task performance and evidence of brain-injury.

Method

Subjects

The subjects were 137 educable mentally retarded children (99 males, 38 females) selected from a public school for special children located in St. Paul, Minnesota.[1] Nearly all children in the school were tested, with the idea that a large sampling of the children attending the school would provide a population of both

familial and brain-injured retardates for the investigation of any possible relationship between the nature of retardation and performance on a paragraph elaboration task. A chronological age range of 8.7-13.1 years, a mental age range of 4.1-10.1 years, and an IQ range of 48 to 92 characterized the subjects tested. All subjects were tested under the same experimental condition.

Materials

The stimulus materials consisted of 12 pictures of common objects which had been cut out of a pre-primer workbook and individually mounted on white cardboard (3.5 x 2.5 inches). Six stimulus-response pairs and paragraph elaborators corresponding to those used by Turnure (1971) were used. Three pairs were elaborated in a two-sentence paragraph where both the stimulus and response terms occurred in the same sentence (Semantic Paragraph--e.g., "Wash the cup with soap. It is very dirty."), and the other three pairs were elaborated in different sentences (Syntactic Paragraph--e.g.,"He is pulling the wagon. It is full of scissors."). In previous investigations (Turnure, 1971; Turnure & Walsh, 1971), both paragraph conditions have produced significant facilitation in paired-associate learning, while showing no significant differences between themselves.

Procedure

All subjects were tested in a paragraph condition in order to investigate possible differential performances by familial and brain-injured retardates. Each subject was initially given a single training trial in which the experimenter covered each response picture

with the card bearing the corresponding stimulus item, and then exposed both pictures together for seven seconds. During these seven seconds, the experimenter orally related the two pictures with the designated two-sentence paragraph, and the subject was required to repeat it. The paragraph elaborators were not repeated by the experimenter after the training trial, and if the subject continued to repeat them in the subsequent learning task, he was told to name only the response item in each pair.

A paired-associate learning task was initiated immediately after the training trial. The stimulus picture of each pair was presented for approximately five seconds and the subject was asked to identify the picture (response term) that was hidden behind it. If an incorrect response was given or it became apparent that no response would be made, an error was scored. For each pair, after the subject had responded or approximately five seconds had passed, the experimenter removed the stimulus picture to expose the picture behind it. The two items were shown together for five seconds, and then the next stimulus item was presented. Presentation of the six stimulus-response pairs in this manner was termed one trial. In order to rule out serial learning effects, the experimenter changed the order of presentation of the six pairs in each trial according to a predetermined random arrangement. Learning scores were expressed as the number of trials to a criterion of two successive errorless trials up to a maximum of 20 trials.

Immediately after criterion had been reached (or 20 trials had been presented) the stimulus and response items of the pairs were reversed. The subject was not told of the reversal, and the task was continued as if no alteration had taken place. Each subject was given two reversal trials, which were scored in terms of the number of errors made.

Classification of subjects

After all subjects had been tested on the paired-associate task, the school medical and psychological records of each child were reviewed and information pertaining to the existence or possible existence of brain-injury was recorded. It should be noted, at this point, that the information available for making a determination of brain-injury was generally scant, and data from neurological testing and diagnosis very rare. On the basis of the information available for each subject, however, and the degree of certainty of brain-injury which it suggested, subjects were assigned to one of three categories: a) positive brain-injury b) questionable brain-injury, and c) no evidence of brain-injury. The criteria for assignment to one of these categories are shown in Table 1. These criteria were developed in the following manner: An associate of the authors, who has had training and experience in the area of mental retardation (Balow, Anderson, Reynolds & Rubin, 1969), was shown the information obtained on the subjects and was requested to indicate which of this information she would consider positive, questionable, or no evidence of brain-injury. On the basis of her

Table 1

Criteria for Classification of Subjects in Categories of

Degree of Certainty of Brain-Injury

Positive brain-injury:

1) History of seizures
2) Cerebral palsy
3) Convulsive disorder
4) Abnormal EEG
5) Multiple problems history--subject suffered from multiple problems which seemed to indicate that brain-damage was highly likely, e.g., legally blind; poor motor coordination; orthopedic condition; premature birth.
6) Cerebral anoxia at birth
7) Encephalitis

Questionable brain-injury:

1) Hyperactivity plus other problems, e.g., hyperactivity; poor motor coordination
2) Multiple problem history--subject suffered from multiple problems which are suggestive of possible brain-injury, but not overwhelming evidence for brain-injury, e.g., birth injury, not defined; skull fracture at three years, no apparent residual effect; perceptual motor problems; speech defect.

No evidence of brain-injury:

1) Poor motor coordination, or speech defect alone, or these two in combination.
2) Hyperactivity alone
3) Mongoloid

comments, the criteria shown in Table 1 were derived. She did not make specific assignments of each child to a category; this task was accomplished by two other raters. On the basis of the criteria which had been established these two raters independently assigned each subject to one of the three categories. The reliability of their ratings was computed by means of a Pearson product-moment correlation and was found to be very high, r = .95.

Results

Acquisition performance on the paired-associate learning task was scored in terms of the number of trials taken to reach a criterion of two successive errorless trials, up to a maximum of 20 trials. As in previous investigations of paragraph elaboration training on paired-associate learning (Turnure, 1971; Turnure & Walsh, 1971), the overall performance of educable mentally retarded subjects was found to be extremely good. Mean trials to criterion was 3.43 (SD = 3.32), where perfect performance is represented by a score of 2.0. The distribution of these scores, however, was extremely skewed: 77.3 percent of the subjects required only two or three trials to reach criterion and 76.4 percent of these subjects obtained a perfect score of 2.0; only three subjects failed to reach criterion within 20 trials.

Reversal performance was scored in terms of the number of errors made out of a possible 12 correct responses. The mean number

of errors made was small ($\bar{X}$ = .80, SD = 1.88), and once again the distribution was severely skewed: 70.8 per cent of the subjects made no errors on the reversal task and an additional 14.6 percent made only one error; three subjects made more than six (50 percent) errors.

The three subjects who made more than 50 percent errors in reversal were the same three who failed to reach criterion in acquisition. In fact, for the sample as a whole, an extremely high correlation was found between the number of trials required to reach criterion and the number of errors made in reversal by each subject (Pearson product-moment r = .97). This finding, together with the above performance data, suggest that while the performance of a large percentage of these educable mentally retarded subjects is obviously very good under paragraph elaboration conditions, a relatively small percentage of them perform poorly on both acquisition and reversal. Subject characteristics were therefore analyzed in order to investigate any relationship that might exist between CA, MA, IQ, sex or brain-injury, and performance on the acquisition and reversal tasks.

Pearson product-moment correlations were also used to investigate the possible relationship between CA, MA, IQ and performance. All correlations between subjects' CA's, MA's and IQ's and performances on both acquisition and reversal were found to be highly significant. The correlations and their significance levels are shown in Table 2. It might be noted that for both acquisition and reversal, the relationships between performance scores and MA and IQ are stronger than that between performance and CA. In general, it may be concluded that the older child and the brighter child performed both acquisition and reversal tasks with fewer errors.

Table 2

Pearson Product-Moment Correlations Between

CA, MA, IQ and Performance

	Trials to Criterion		Reversal Errors	
	r	Signif.level	r	Signif.level
CA	-.25	Z = 2.92 p <.004	-.23	Z = -2.67 p <.007
MA	-.33	Z = -3.83 p <.001	-.40	Z = -4.63 p <.001
IQ	-.32	Z = -3.72 p <.001	-.38	Z = -4.40 p <.001

The relationships of performance and of sex to classification as brain-injured were tested initially by means of chi-square tests. For these analyses performance scores were dichotomized in two ways: a) "no errors (or two trials to criterion)" versus "errors (or, three or more trials to criterion)"; and b) "0 or 1 errors (two or three trials to criterion)" versus "2 or more errors (four or more trials to criterion)". This was done in order to see if a less strict dichotomy i.e., a dichotomy which combined subjects with only one error on reversal (or those with one trial beyond perfect performance on acquisition) with subjects making no errors (or perfect acquisition), might more clearly demonstrate a relationship between performance scores and classification by sex or brain-injury. The basic rationale for this decision was, of course, that anyone might make an error sometime, but that this need not imply brain-injury.

In the first of these analyses a chi-square test of the proportions of male and female subjects making "no errors" versus the proportions making "errors" was performed for both acquisition and reversal scores. No significant sex differences were found for either the acquisition task ($x^2 = .03$, $df = 1$, $p > .90$) or for the reversal task ($x^2 = .64$, $df = 1$, $p > .25$). However, when the proportion of males and females making "0 or 1 errors" was compared to those making "2 or more errors" the chi-square tests became significant (Acquisition: $x^2 = 4.0$, $df = 1$, $p < .05$; Reversal: $x^2 = 4.5$, $df = 1$, $p < .05$). This latter finding was substantiated by tests of proportions which were also significant for both acquisition and reversal ($z = 3.08$, $p < .002$ and $z = 2.80$, $p < .006$, respectively). It appears, then, that a greater proportion of males

were performing at a level of "0 or 1 errors," and a smaller proportion at a level of "two or more errors," than was the case for the females (see Table 3). It might be noted at this point, that despite the differential proportion of males and females making "0 or 1 errors" and "2 or more errors," the proportion of males and females categorized as brain-injured (positive and questionable combined) was not found to be significantly different by a test of proportions ($z = -1.80$, $p > .08$).

A series of chi-square analyses were also performed in order to investigate the relationship of classification as brain-injured and acquisition and reversal performance. The initial chi-square analyses were 2 x 3 analyses in which "no error" versus "error" subjects in the three brain-injury categories--positive, questionable, and no evidence--were compared. These chi-squares were found to be nonsignificant for both acquisition ($x^2 = 2.2$, $df = 2$, $p > .25$) and reversal ($x^2 = 2.3$, $df = 2$, $p > .25$), as were 2 x 2 chi-squares in which the positive and questionable brain-injured categories were combined and compared to the no evidence category for subjects making "no errors" versus those making "errors" (Acquisition: $x^2 = 1.9$, $df = 1$, $p > .10$; Reversal: $x^2 = 1.8$, $df = 1$, $p > .10$). Again, it was not until the combined positive and questionable brain-injured category was compared to the no evidence category for subjects making "0 or 1 errors" versus those making "2 or more errors," that a significant difference emerged. Analyses of acquisition data in this manner resulted in a significant chi-square ($x^2 = 3.8$, $df = 1$, $p < .05$); however, a similar chi-square analysis of reversal errors was not found to be significant

Table 3

Proportions of Males and Females at Two Error Levels for Acquisition and Reversal

	Error levels	
	0 or 1 Errors	2 or more Errors
Acquisition		
Males	.818	.182
Females	.658	.342
Reversal		
Males	.889	.111
Females	.763	.237

(x^2 = 2.0, df = 1, p >.10). Interestingly, when the acquisition data is broken down to an even greater degree, i.e., two or three trials to criterion, 4 or 5 trials to criterion and greater than five trials to criterion (see Table 4), then differences between the two categories of brain-injury emerge even more sharply (x^2 = 10.4, df = 2, p <.01).

Discussion

The results of the present study are clearly consistent with the findings in the earlier Turnure studies (Turnure, 1971; Turnure & Walsh, 1971) with educable mentally retarded children, in that paired-associate learning and reversal were greatly facilitated under paragraph elaboration conditions. Once again, it can be seen that a general characterization of mentally retarded children as having inadequate or "inert" language ability seems to be inappropriate. The subjects here, similar to those in the Turnure studies, reached criterion in approximately one to two trials beyond perfect performance, and reversed, on an average, with less than one error. The variance in the present study, however, was considerably higher for both acquisition and reversal than in the previous Turnure studies, and it seems reasonable to conclude that this can be attributed to the wider CA, MA, and IQ range of the subjects employed in the present research. Correlations of both acquisition and reversal performance with these variables indicated a significant inverse relationship in every case, a finding which seems clearly consistent with the greater variability and range of CA's, MA's and IQ's in this sample. These correlational analyses

Table 4

Percentage of Subjects in Two Brain-Injury Categories at Three Acquisition Score Levels

Acquisition Scores	Brain-Injury Classification			
	No evidence of brain-injury		Positive or questionable brain-injury	
	%	n	%	n
2 or 3 trials to criterion	81.1	86	64.5	20
4 or 5 trials to criterion	13.2	14	9.7	3
>5 trials to criterion	5.7	6	25.8	8
Total		106		31

showing significantly better performance for the older and brighter subjects provide the clearest finding of this study.

The analyses relating classification of brain-injury to paired-associate performance, however, are by no means clear. Significant findings do not appear until subjects in the combined positive and questionable brain-injury category taking two or three trials to criterion versus those taking four or more trials to criterion (two trials to criterion denotes errorless performance) were compared to similar groups of subjects who had no evidence of brain-injury. A further breakdown of the scores greater than four results in somewhat more significant brain-injury category differences. Thus, the present study provides, at least with regard to acquisition of paired-associates, some evidence of differential performance of brain-injured and non-brain-injured subjects given elaboration training, particularly when extremely poor scores are considered in more detail.

It should be recalled that the data obtained from school records, which were used not only to classify the subjects as brain-injured, but also to formulate the criteria used in classifying them, were at best inadequate and at worst, possibly unreliable and incomplete. Perhaps, if more firm diagnoses of brain-injury had been available to use in these analyses, clearer differences in performance might have emerged. This, in fact, would seem to be a minimum requirement for an adequate test of Luria's contention that mentally retarded subjects are characterized by "inert" language systems, particularly in view of the fact that Luria (1963) is so careful to state that he is referring

only to brain-injured children as determined by neurological testing.

The present study suggests, although very tentatively, that the distinction between brain-injured and non-brain-injured retardates may be an important one to make when investigating language and learning abilities of retarded children. In view of the fact that many subjects performed extremely well even though they had been designated as brain-injured, a more definitive determination of brain-injury seems to be essential as does, perhaps, a clearer description of what is meant by the notion of an "inert" or inadequate language system.

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II. Elaboration Training and Transfer Effects in First-Grade Children with Learning Problems

James E. Turnure and Martha L. Thurlow

Soon after research in the area of verbal elaboration was started, researchers noted the large facilitory effect of elaboration on the learning of paired-associates. They reasoned that individuals given elaboration training, i.e., learning word pairs presented within an elaborated context such as a sentence, might utilize this helpful procedure when later asked to learn a new list of word pairs not presented in such a context. If the trained individuals were able to learn the new word pairs better than individuals who had not had elaboration training, it would provide welcome evidence of transfer. However, various attempts to demonstrate transfer of elaboration training effects over a period of one week in retarded individuals have been unsuccessful (Jensen & Rohwer, 1963; Milgram, 1967).

Jensen and Rohwer (1963) originally gave a paired-associate task to adult retardates under either an elaboration condition in which the pairs were initially presented within a sentence context, or a control condition in which the pairs were presented in a standard paired-associate anticipation task. When the two groups of subjects were retested 10 to 12 days later with the standard anticipation task they did not differ significantly from

each other in the mean number of errors made on the retest, as would be expected if transfer had occurred. More recently, Milgram (1967) has attempted to demonstrate transfer effects in institutionalized retardates by modifying the Jensen and Rohwer paradigm in order to enhance the effects of an elaboration task and to increase their potential for transfer. Milgram attempted to train his subjects to use elaboration techniques in learning a paired-associate list by giving them several lists to learn the first week under varying degrees of elaboration (experimenter-provided elaboration, subject-generated elaboration, and no elaboration instructions). Subjects were then tested one week later without any instructions to elaborate. Although the retardates benefited significantly from the elaboration instructions during the first week, Milgram found that they were no better than subjects who had not been given the elaboration training when asked to learn a comparable list one week later without the specific instructions to elaborate.

At least three possible reasons for the failure of Jensen and Rohwer (1963) and Milgram (1967) to find transfer effects might be suggested. Both studies employed retarded subjects with a history of institutionalization. Turnure and Walsh (1971) recently pointed out that there are unspecified selection factors operating on the general population of retarded children, which result in only a small proportion of them entering and remaining in institutions into adulthood. Zigler (1966, pp. 122-125) has suggested that the

population of retarded individuals may actually encompass two different populations as well -- organic retardates and familial retardates. If this is the case, the population of organic retardates found in instituions might perform differently on an elaboration task (cf. Study I, this report), and possibly also on a transfer task, than the population of familial retardates. This performance difference could, therefore, mask any evidence of positive transfer by the familials. A study which employs educable retardates from within a public school might find transfer effects not generally obtainable in institutionalized retardates. A second possible reason for the failure to find transfer effects might be that neither the Jensen and Rohwer (1963) nor the Milgram (1967) elaboration conditions were successful in enhancing elaboration efficiency to the degree that it would be beneficial for the subjects to transfer. An elaboration condition which facilitates paired-associate learning beyond that of a sentence might allow for transfer effects to be found. Finally, it is possible that neither Jensen and Rohwer (1963) nor Milgram (1967) gave subjects sufficient elaboration experience to provide a basis for transfer to occur.

A recent study by Turnure and Walsh (1971) suggests that transfer effects might be obtained when these conditions are met. Assuming negligible transfer effects from elaboration instructions (as implied by both the Jensen and Rohwer, 1963, and the Milgram, 1967, studies), they examined the effects of three elaboration conditions (labeling, sentence elaboration, and paragraph elaboration)

using a Latin square with repeated measures design. All educable retarded subjects were exposed to the three conditions, in various orders, with an interval of at least one week between exposure to each condition. Although no carry-over effects were expected, a significant Condition x Day interaction emerged. Further investigation of the data suggested that only the labeling condition subjects showed significant improvement over the three days. These results led Turnure and Walsh to suggest the possibility of significant transfer of training effects from the syntactic conditions (sentences and paragraphs) to the labeling condition. A subsequent study by Turnure (1971) again found that the extended form of elaboration (the paragraph) significantly facilitated paired-associate learning beyond that of a simple sentence. This might indicate that a paragraph would be a more efficient elaborator to use in attempting to obtain transfer effects. These findings thus suggest the need for further investigation of the transfer of training effects of verbal elaboration, specifically with non-institutionalized retardates given an extended form of elaboration.

Before such a study could be initiated, however, it was felt that some preliminary research would give an indication of the adequacy of the above arguments and provide a test of experimental procedures. In the first place, a pilot study would indicate whether an experimental procedure designed to investigate transfer effects would show those which had been suggested by Turnure and Walsh. To conserve time, it was decided that this preliminary study would

attempt to obtain transfer over a period of 24 hours. If transfer could not be obtained over this period of time, the adequacy of the above arguments or the experimental procedures would definitely be questioned. Also, since the Turnure and Walsh study investigated reversal performance after each list had been learned, it is possible that the indication of transfer effects might have been due to some process occurring during the reversal task rather than to the process of elaboration itself. A pilot study would allow for the separation of these two processes. Furthermore, the pilot study was conducted to test new procedures for recording experimental timing, and to obtain information on the response latencies of subjects in the various conditions.

Method

Subjects

The subjects were 14 children from a public school in St. Paul, Minnesota.[1] The children were members of a transitional first-grade class. They had been placed there on the recommendation of their kindergarten teacher, who for various reasons, felt that these children had learning problems and would be unable to succeed in a regular first-grade classroom. Because two children were absent on the first day of testing, the remaining 12 children were randomly assigned to the three experimental groups, such that the mean CA of the four children within each group was the same (6-8 years). The other two children (6-1 and 6-3 years) were present on the second and third days of testing and were thus tested under a modified transfer condition.

Materials

The stimulus materials consisted of 36 colored pictures of common objects which had been cut out of a pre-primer workbook. The pictures were mounted on pieces of white cardboard (3.5 x 2.5 in.), and then 18 stimulus - response pairs were formed. From these pairs, three lists of 6 pairs were formed by randomly assigning each pair to one list; a two-sentence elaborator was then constructed for each pair. In each list, one-half of the word pairs were elaborated within a semantic paragraph, where both the stimulus and response items occurred in the first sentence of the paragraph; the other three word pairs were related by means of a syntactic paragraph in which the stimulus item occurred in the first sentence and the response item in the second.

Procedure

Two learning conditions were used in order to look at transfer effects over three days: Paragraph Elaboration and Labeling. Identical instructions were given for both conditions on all testing days. On each day a single training trial was given initially. The experimenter covered each response picture with the card bearing the stimulus item and then exposed them together for seven seconds. During this period, the subject in the Paragraph Elaboration (PE) condition was required to repeat the two-sentence paragraph given by the experimenter. In the Labeling (L) condition, the subject was required to repeat after the experimenter the names of the stimulus

and response items. In both conditions, the training procedures was carried out once for each of the six paired-associates in each list. The elaborators or labels were not repeated by the experimenter after the training trial.

After the training trial, subjects in all conditions were given the same learning task. The stimulus picture was exposed alone until the subject responded, up to a period of 20 seconds. If no response or an incorrect response was given, an error was scored. For each pair, as soon as the subject responded or after 20 seconds, the experimenter removed the top card (stimulus) and allowed the subject to see both the stimulus and response items together for five seconds. Presentation of the six paired-associates in this manner was termed a trial. In order to rule out positional cues, the experimenter changed the order of presentation of the pairs according to a pre-arranged random order. Learning scores were expressed in terms of the number of trials to reach a criterion of two successive errorless trials, up to a maximum of 15 trials.

In three of the four transfer conditions employed in the present study, a reversal manipulation was introduced after acquisition to investigate the effects of the reversal process on subsequent transfer effects. In the reversal task (R), immediately after the subject had learned to criterion (or after 15 trials) the stimulus and response items of the pairs were reversed. Thus, the subject was required to give the name of the stimulus item which corresponded to the response picture shown to him. The subject was not told of

the reversal, and the task continued in the same manner as in the acquisition stage. Each subject given the reversal task received two reversal trials for each list. All subjects were given the reversal trials following the final list.

Transfer Conditions. In order to test for the transfer effects of learning under an elaboration condition to learning under non-elaboration conditions, three basic transfer conditions were examined: Group I received a L_R-L_R-L_R condition; Group II received a PE_R-PE_R-L_R condition; and Group III received a PE-PE-L_R condition. This last condition was tested in order to identify possible transfer effects that might take place after elaboration training without reversal experience. The two children who had been absent on the first day of testing were put into a fourth group and received a PE_R-L_R condition, which allowed for a test of the transfer effects after only one elaboration experience. The test days for all groups were separated by a period of 24 hours. Each subject received a different list on each of the three test days. To control for possible effects of differential list difficulty, the order of presentation of lists across all subjects under each transfer condition was counter-balanced.

Response Latency Timing. As Esterline-Angus event recorder was used to measure the response latencies of each subject under the various experimental conditions. A single response latency measure was defined as the time between the presentation of the stimulus picture by the experimenter and the subject's first complete

response, regardless of whether it was correct or not. Response latencies were measured during both acquisition and reversal stages on all three days of the testing.

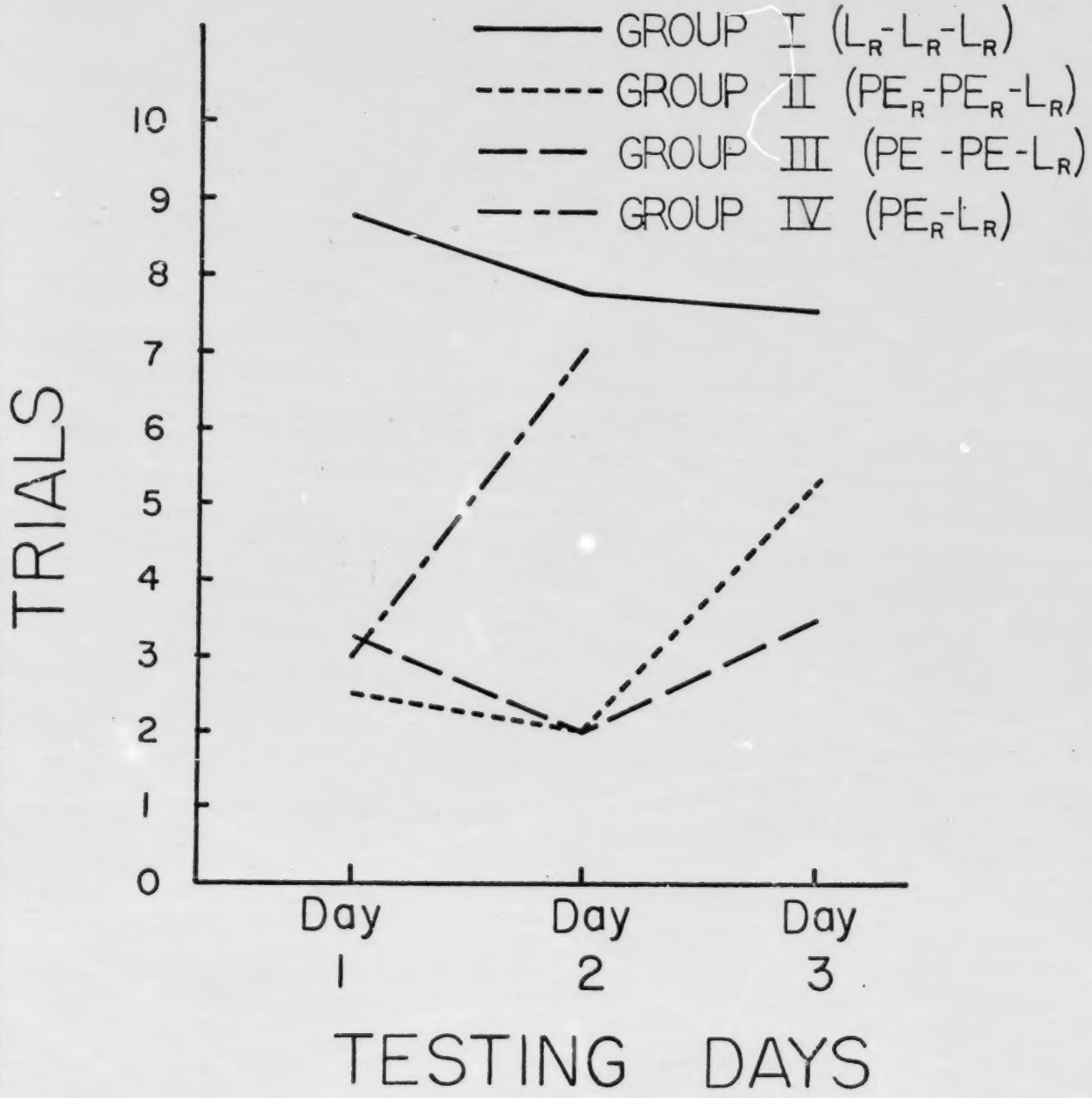
Results

Acquisition

Figure 1 graphically presents the mean number of trials required to learn a list of 6 paired-associates on each day of testing. On the basis of previous findings (Turnure, 1971; Turnure & Walsh, 1971), one would expect that on Day 1 the group receiving labeling (Group I) would take a significantly greater number of trials to learn the list of paired-associates than would those receiving paragraph elaborators (Groups II and III). A similar pattern would be expected on Day 2, although each mean might be smaller due to the occurrence of practice effects. These expectations appear to be met in the present data. Analyses of variance of the mean number of trials to criterion on the first two testing days shows that there were significant conditions effects (Day 1: $F = 10.35$; $df = 2,9$; $p < .005$; Day 2: $F = 5.31$; $df = 2,9$; $p < .05$). A Newman-Keuls comparison of the means revealed that on both days the labeling condition group required significantly more trials to criterion than the paragraph condition groups, which did not differ from each other. It thus appears that subjects in the labeling and elaboration conditions are related to each other in a manner similar to that found in previous experiments. The critical test for the existence of transfer effects thus becomes their performances on

Figure 1

Mean Trials to Criterion on Three Testing Days



the third day of testing (Day 2 for Group IV), when all subjects were presented the word pairs to be learned in a labeling condition.

One would expect that if no transfer occurred as a result of prior experience with an elaboration condition, Groups II and III would perform at approximately the same level as Group I on Day 3. Observation of Figure 1 indicates that this was not the case. Group I, which was in a labeling condition on all three testing days, required 7.50 trials on Day 3, approximately the same number of trials as on Day 2. Some practice effects are noticeable, but these are small. Group II, which received paragraph elaborators with a reversal task on the first two days of testing, required 5.25 trials on Day 3. It should be noted, however, that the performances of individual subjects in this condition were quite variable on the third day of testing. Two of the subjects required only 2 and 4 trials, while the other two required 7 and 8, the latter being comparable to the level of performance of subjects in the labeling condition. It thus appears that although the mean for subjects in the PE_R-PE_R-L_R condition was smaller than for subjects in the L_R-L_R-L_R condition, the only valid conclusion is that some subjects appear to transfer while others do not. Group III, which received paragraph elaborators but no reversal task on the first two days, required 3.50 trials to learn the new list; three of the four subjects showed evidence of transfer.

Analysis of variance of trials to criterion on the third day of testing revealed significant conditions effects (F = 21.45;

$df = 2,9$; $p < .001$). A Newman-Keuls comparison of means shows that all three means were significantly different from each other. Both Groups II and III required a fewer mean number of trials on the third day than did Group I. The additional finding that subjects who had been given elaboration conditions without a reversal task (Group III) required significantly fewer trials than those subjects who had been given an elaboration condition with a reversal task (Group II) was unexpected. Again it should be noted that this finding is apparently a result of the fact that two of the subjects in Group II did not appear to transfer.

The performance of the two Group IV subjects also appears in Figure 1. As with Group II, the mean performance of these two subjects on Day 2 is misleading. One subject required 3 trials to learn the list under non-elaborated conditions, a level of performance which seems consistent with transfer effects, while the other subject required 11 trials. The only valid conclusion would appear to be that after a single experience with elaboration, some individuals show positive transfer while others manifest negative transfer.

Reversal

Table 1 presents the number of correct responses given during two reversal trials (12 possible) each day in the three transfer conditions. Because Group III was used to provide a test of transfer effects in the absence of experience with a reversal condition, no reversal trials were given to these subjects on Days 1 and 2.

Table 1

Means and Standard Deviations of the Number Correct on Reversal for Three Treatment Groups

Treatment Group		DAY 1	DAY 2	DAY 3
Group I (L_R-L_R-L_R)	$\bar{X}$	7.75	9.50	10.25
	SD	2.22	3.11	.96
Group II (PE_R-PE_R-L_R)	$\bar{X}$	11.25	11.25	11.25
	SD	.96	.50	.96
Group III (PE-PE-L_R)	$\bar{X}$	----	----	11.75
	SD			.50

Significant differences were found between groups only on Day 1 (F = 8.39; df = 1,6; $p < .05$). The performance of subjects given the reversal task following an elaboration condition was thus significantly greater than that of subjects given the reversal task following a labeling condition. This was true only on Day 1, when neither group had had previous experience with the reversal task. This pattern is consistent with that found by Turnure and Walsh (1971). On Day 3 the subjects in the labeling condition, perhaps due to their practice on the reversal task, were able to perform at nearly the same level as subjects formerly in a paragraph elaboration condition. Furthermore, the performance of subjects in Group III on the reversal task suggests that the high level of reversal performance by subjects who had previously received words in an elaborated context appears to hold whether or not the subjects "expect" a reversal of the pairs, and despite their previous lack of practice on the reversal task.

Response latencies. The mean overall response latencies for acquisition and reversal performance within the three major comparison groups are shown in Table 2. An analysis of variance revealed a significant difference between the transfer conditions only on Day 1 (F = 8.32; df = 2,9; $p < .01$). Further analysis, using the Newman - Keuls test for differences among means, showed that the mean acquisition response latency for subjects in the labeling condition was significantly longer than for subjects in either paragraph condition (PE-PE-L_R: $p < .05$; PE_R-PE_R-L_R: $p < .01$).

Table 2

Means and Standard Deviations of Response Latencies during Acquisition and Reversal for Three Treatment Groups

	Acquisition			Reversal		
	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
Treatment Group						
L_R-L_R-L_R						
$\bar{X}$	8.22	6.34	6.57	7.76	6.98	5.46
SD	1.39	2.38	1.11	1.94	3.64	2.14
PE_R-PE_R-L_R						
$\bar{X}$	3.92	3.06	5.05	3.37	3.88	5.36
SD	.68	1.07	1.36	.89	.89	1.60
PE-PE-L_R						
$\bar{X}$	5.27	4.50	6.04	----	----	5.95
SD	2.14	1.42	1.32	----	----	.99

It should be noted, however, that these overall response latencies included latencies for three types of responses -- correct responses, errors, and no responses. Separation of the overall response latency scores into these three types suggested that the longer latency attributed to subjects in the L_R-L_R-L_R condition on Day 1 was due to the greater number of no response scores present there. Observation of the latencies for correct and incorrect responses suggested that there was a difference between the time taken for subjects to give a correct response as compared to an incorrect one. In nearly all cases, response latencies for incorrect responses were 2 to 4 seconds longer than for correct responses. Due to the small sample sizes of the groups, however, no significant differences were found in analyzing these data.

Response latencies over the two reversal trials were compared for the two transfer groups which received a reversal condition on all three days of testing (L_R-L_R-L_R and PE_R-PE_R-L_R). A t test revealed that there was a significant difference between the response latencies only on Day 1 ($t = 3.56$; $df = 6$; $p < .02$). Subjects in the labeling condition took significantly longer periods of time to respond to the reversed paired-associates.

Discussion

The present study was designed to assess the adequacy of arguments for further transfer research and to test the proposed experimental procedures. Although the subjects tested had not been classified as retarded, and the testing interval was only 24 hours, the results of the present study do provide evidence that further

investigation of transfer of training effects would be profitable.

The presentation of paired-associates within a verbal context was once again found to significantly facilitate the learning of word pairs. On both Days 1 and 2 the labeling condition group (L_R-L_R-L_R) required significantly more trials to reach criterion than the paragraph condition groups (PF-PE-L_R and PE_R-PE_R-L_R). On the third day of testing, when these three main comparison groups were observed in the same labeling condition, there was clear evidence of the positive effects of prior paragraph training. Performance of subjects in both the PE-PE-L_R and the PE_R-PE_R-L_R groups was superior to that of the control (L_R-L_R-L_R) group. It is worth noting, however, that not all subjects given two days of paragraph elaboration training benefited in any obvious way from the training. At least two of the subjects in these groups performed at the same level as subjects with no elaboration training. Furthermore, for the pair of subjects receiving just one day's practice with paragraphs (PE_R-L_R), only one showed clear positive transfer, while the other performed so poorly as to suggest the possibility of negative transfer. Nevertheless, the statistically significant finding obtained with subjects given two days of elaboration training is in accord with the previous finding by Turnure and Walsh (1971), and supports the transfer of training interpretation they advanced to account for it.

Results of the reversal manipulation for the first day of testing reflect the findings obtained previously by Turnure

and Walsh (1971). The ability to give the stimulus item, when shown the response item, was significantly better when the pairs were first learned under an elaboration condition, rather than under a labeling condition. With practice on the reversal task, however, reversal performance becomes extremely good and differences between elaboration and labeling groups disappear.

It thus appears that for these subjects, the experience in using experimenter-provided contexts for relating paired-associate items has beneficial effects on subsequent paired-associate performance when elaborative contexts are not provided. The experimental procedures employed in the present study would therefore seem to be valuable ones for use when educable retarded children are employed as subjects and when the transfer interval is increased to one week.

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Footnote

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